JOURNAL

OF THE

AMERICAN FOUNDRYMEN'S ASSOCIATION.

VOL. 4. JUNE, 1898. NO. 24.

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PHILADELPHIA FOUNDRYMEN'S ASSOCIATION.

The seventy-sixth meeting of the Philadelphia Foundrymen's Association was held at the Manufacturers' Club, in Philadelphia, on Wednesday, May 4, the president, P. D. Wanner, presiding.

The purport of the meeting was to find out as far as possible what effect the war was having and was likely to have on the foundry business. Responses were made by members from outlying towns as well as from Philadelphia foundrymen, and while there were different shades of feeling and different opinions as to final results, it was unanimously agreed that business was better now than at any time since the association was founded. It was agreed that prices are too low and very little better than the lowest, but with shops full of work and plenty more in sight the feeling was distinctly cheerful. The president, Mr. Wanner, of Reading, made the concluding address, which seemed to exactly meet the views of all who were present, and was as follows:

Dr. Franklin said that there never was a good war nor a bad peace. Peace, like honesty, is no doubt the best policy, but it would seem that in the intercourse and economy of nations war, at certain times, becomes inevitable. Accepting the war with Spain in this sense, it becomes our duty as patriotic and loyal citizens to stand by the government to the end, whatever the result.

When we reflect upon the relative strength and resources of Spain and this country the war should be of short duration, or, rather, it should be "short, sharp and decisive."

Mr. C. P. Warner said:

"The effect of war on business at first will be depressing, but as it assumes a more earnest and definite form it will help it, especially so in all lines pertaining to army and navy supplies. It will also advance prices and values. All the wars of this country have terminated successfully, their effect was invariably beneficial to all its industrial, commercial and financial interests. The country after the revolutionary war enjoyed a wonderful degree of prosperity for a period of over twenty years; indeed, unpecedented in the world's history. The war of 1812 had a like effect upon its conclusion, and with a war or higher protective tariff gave the country renewed prosperity up to the panic of 1819. The Mexican war in 1846 proved also of great benefit, coming at a time, too, when there was great discontent and suffering, prolonged after the panic of 1837. The result of that war, however, and with the discovery of gold in California and large acquisitions of territory, gave the country prosperity until the panic of 1857. The war of the rebellion of 1861 had a bad effect upon all industrials, except what was needed in that line by the government, until the latter part of 1862, when business revived generally and kept on improving until the restoration of peace. After that we had good and very prosperous times until the panic of 1873. The enduring feature of that continued prosperity was mainly due to a high protective tariff, and which again carried the country out of and over the panic of the '70's, and gave it another period of great prosperity during the '80's, and up to the panic of '93.

"The advantages of a protective, or high tariff, will be absent in the present contingency, because it has lost its former prestige, or no longer protects as it did then, and we are face to face in competition with the world. The good effect of this war, after its termination, will be a more perfect union of all our people,

probably less politics and more patriotism, the expenditure of large sums of money on the navy, the establishment of a merchant marine, a still larger and larger foreign trade, and the realization of the fact that we are not only one of the greatest nations upon land, but also upon the seas; the restoration of complete confidence in the unity and conscious greatness of our people, and the bringing to them of plenty and prosperity for years to come."

WESTERN FOUNDRYMEN'S ASSOCIATION.

The annual meeting of the Western Foundrymen's Association was held Wednesday, May 18, 1898, at 7:30 p. m., at the Great Northern Hotel, Chicago, with the president, C. A. Sercomb, in the chair.

PRESIDENT'S REPORT.

"Early in 1893 a few foundrymen, possessed of the idea that a Foundrymen's Association based on educational lines would be of benefit to those engaged in iron manufacturing, met in Chicago. I may be excused when I mention the fact that I had the honor to be chosen president pro tem. of the organization. This corporal's guard has had the satisfaction of witnessing a growth to a company numbering 113. Interest in an organization of this kind by those engaged in iron industries should not be permitted to flag. We wish to know if it is advisable to throw away all the charts and guides of the past and continue to work by rule of thumb, or make a short cut and learn from the knowledge and experience of others in similar pursuits, and combine their knowledge with ours; in fact, to use, if possible, the brains of others. It is hard to maintain an organization of this kind, and if we have succeeded to a large extent through five years of great depression, then our work is to be commended and we should feel encouraged. We should not permit ourselves to retreat into obscurity because we have not accomplished as much as we could desire; for in spite of our shortcomings we stand in the front rank of the great army that is pushing on to improvement. Ideas may be formulated that are perfect in themselves, but they cannot be established unless a sufficient number understand their purpose and value. The work of the association is appreciated, as is shown by the publication of papers read at our meetings, and the discussion thereon in journals throughout the country. The organization accomplishes much by bringing the foundrymen and supply men together and making us better acquainted with each other. The pleasant acquaintances I have made since being con-

nected with the association have been of value to me in many ways. The questions and papers brought before the association for discussion are interesting and valuable, and our association is destined to exert a great influence in placing its members high in the ranks of intelligent foundrymen. The social side has never been made prominent—scarcely enough so. We must be entertained if we are to secure the greatest interest and the best results, and it might be well to have our editing committee act also as an entertainment committee.

"The meeting called at Cincinnati last September was disappointing as to the number of our members who attended, but there was a compensating feature in the large attendance of foundrymen from all parts of the country. Everything was done for our entertainment and to make our visit pleasant, combining business with a general good time. Invitations to visit the Chamber of Commerce, the S. Obermayer Co.'s plant and the Niles Tool Works were accepted.

"To the officers of the association I wish to extend my thanks for their unselfish support, and to the members for their assistance and good-will."

SECRETARY'S REPORT.

"I have the honor to submit herewith my annual report as secretary of your association for the past year. At the last annual meeting there were reported 110 names on our membership roll. In spite of continued business depression this number has been increased to 113 during the past year. Since the last annual meeting there have been elected eighteen new members. On the other hand we have lost, by failure in business, resignation and death, fifteen. The list of members showed one year ago ten of the total number had not qualified. This year shows nine such delinquents. Of these nine there are four carried over from last year, and I would suggest that a final notice be sent to delinquents, giving them thirty days to complete their membership, otherwise their names to be erased from the roll.

"A most successful out-of-town meeting was held in Cincinnati during October, 1897. This added fourteen new names to our

roll, and the meeting was distinguished by the excellence of its papers and discussions, as well as by the lavish hospitality shown by the Cincinnati foundrymen and supply men. This was duly acknowledged by appropriate resolutions passed by the association, but I feel that I desire to add my own personal thanks for the kindness of our friends.

"The by-laws of the association were amended and put into final shape during the past year, and I hope that the interest in our work will grow continually. The Western Foundrymen's Association has during the past year retained its leading position and has acted as pioneer in various directions in which other foundrymen's associations have followed. The high standard of the work done is acknowledged universally, and a continuance of the earnest efforts heretofore put forth is bound to produce increasingly valuable results.

"In retiring from office I wish to thank the officers, board of directors, editing committee and members of the Western Foundrymen's Association for the uniform kindness and courtesy shown me in my effort to do the work assigned me. I feel my severance from your service keenly, but trust that my successor may carry on the good work with continually growing success, and bespeak for him your full and unqualified assistance."

The following officers were elected for the ensuing year:

President—G. H. Carver.

Vice-President—A. M. Thompson.

Secretary—B. M. Gardner.

Treasurer—O. T. Stantial.

Board of Directors—A. M. Thompson, S. T. Johnston, W. N. Moore, C. A. Sercomb, and W. A. Jones.

Editing Committee—Henry W. Carter, B. M. Gardner, and S. T. Johnston.

On taking the chair, the new president, G. H. Carver, made a short speech of thanks for the honor conferred upon him, and promised to use his efforts for the furtherance of the interests of the association during his term of office. A rising vote of thanks

was tendered the retiring officers for their services during the past year, and the meeting adjourned.

After the adjournment the members proceeded to the Palm Garden of the Great Northern Hotel, where they partook of a light supper which had been prepared for their entertainment.

PITTSBURG FOUNDRYMEN'S ASSOCIATION.

At the May meeting of this association the committee appointed to arrange for the standardizing of cast iron drillings, reported through Dr. Moldenke that it had gone over the ground carefully, considering first the question of cost and then the best method of carrying out the work of preparation and distribution of the samples. The committee further announced that Profs. Benjamin and Smith, of the Case School of Applied Science, had kindly consented to supervise this important work, and will give their personal attention to every detail. The integrity of the samples will therefore be above criticism. The analytical work will be performed in four of the best known laboratories of the country, and effort made to have the same methods used throughout, and a copy of these will accompany each sample issued to the purchaser. In order to ascertain the degree of practical interest taken in this matter, the committee is sending out a letter, of which the following is a copy:

Dear Sir:—This letter is forwarded to you by a committee appointed at the April meeting of the Pittsburg Foundrymen's Association to investigate and forward the idea of establishing a central agency for the distribution of standardized drillings of cast iron. The view is held that this work would also encourage the early adoption of standard analytical methods in the laboratories dealing with cast iron, whether at furnace or foundry.

The sample would be taken from a cylinder 1½ inch thick, cast on end in a dry sand mold. The casting would be centered in a lathe, the skin removed, and about 1 inch of the inner body turned off. This material would be thoroughly mixed by competent persons under the direction of the professors of Case School of Applied Science, who would at the same time arrange for the work of standardizing. The following chemists will do the analytical work: Booth, Garret & Blair, of Philadelphia; Case School of Applied Science; Cremer & Bicknell, Cleveland, and A. S. McCree, Harrisburg, Pa. They will, moreover, agree

upon the same methods, copies of which will accompany each sample of drillings sent out to individual firms.

In order to test the practicability of starting such an agency, the committee has thought it best to solicit advance orders for such standardized drillings. For the sum of $5 there will be furnished one pound (Troy) of the samples, as follows: Four ounces to go as soon as the drillings are standardized, and the purchaser to have the option of taking the other eight ounces either of the same material reserved for him, which will be of foundry iron drillings or one of two other standard samples to be gotten out if warranted by the demand. One pound should furnish enough material for 36 complete analyses, or at least 200 separate determinations. The price set is very low, the aim being to establish a central standardizing agency, and not to make profits. Trusting you can assist this movement by sending an early advance order for $5 worth of standardized drillings to any of the following committee, we are,

Respectfully yours,

THOS. D. WEST,
Sharpsville, Pa.

ISAAC W. FRANK,
54th st. and A. V. Ry., Pittsburg.

RICHARD MOLDENKE,
48th st. and A. V. Ry., Pittsburg.

Dr. Moldenke, in reporting for this committee, stated that the members of the association who have laboratories will undoubtedly see the value of the work without further explanation. Those who do not feel ready as yet to go to the expense of establishing and maintaining a chemical department, but have their analyses made outside, will also do well to purchase standardized samples. Where the returns of analyses do not seem to be comparable with the work in question, in justice to their interests they had better test the accuracy of the analyses they are paying for; and on the other hand, in justice to the chemist, an approximately correct return of the standard analyses should cause the founder to look for the trouble elsewhere. The members of the committee

will be pleased to receive advance orders, so that when reporting to the American Foundrymen's Association, a fair idea of the probable outcome of the movement may be based upon the returns as far as then received. The first advance order, one from the McConway & Torley Company, had already been received.

The paper on "Foundry Appliances," which follows, was read by the secretary, in the absence of the author, Mr. S. H. Stupakoff, of the Union Switch & Signal Company. Discussion of the paper was postponed until the June meeting.

FOUNDRY APPLIANCES.

Foundrymen, as a rule, pay close attention to the general outfit of their foundries. They are careful in the selection and in the construction of their cupolas, their blowers or fans, their core ovens and cranes. Taking into consideration the various purposes for which different foundries are fitted, whether for casting light or heavy machinery, stoves, hardware, pipe, rolls, malleable iron, steel or bronze, each has its peculiar arrangements, and each may vary considerably from others in its details; yet the general rule of equipment is followed by all. Of course, every foundryman knows there is considerable difference between the cupola of a gray iron foundry, the reverberatory furnace of the malleable foundry, and the open-hearth furnace of the steel foundry; but excepting these latter, which properly belong in a class of themselves, the gray iron foundry equipments very much resemble each other. Likewise the supplies are very much the same, though each specialty has its peculiarly adapted sands, facings, etc. But there exists a wide range of divergency in the foundry appliances, which are to be separately grouped from the fixtures and the supplies.

Conveyances for the raw material are mostly limited to the elevator for pig and coke. In some instances an elevated track is provided which furnishes the material at a level with the charging floor, while in most cases, mechanically, electrically, or hydraulically operated elevators are made use of for this purpose. Comparatively few foundries are equipped with sand conveyors; though, where introduced and where intelligently manipulated,

they effect a considerable saving in labor. Conveyances for handling the molten metal are usually a traveling or swinging crane, or both, and generally only foundries making heavy castings enjoy the benefits derived from the use of either one of these. Small foundries, or those equipped for light or medium light work have the metal carried in ladles to their destination.

The next important things for the foundryman are his flasks. These may be divided into wooden and iron flasks, and again into ordinary and snap flasks.

Adding to the equipment mentioned above the cleaning barrel and a core oven, and we have a full outfit of an ordinary old-fashioned foundry, which would be ready to make and furnish castings for the market. But it is questionable if such a foundry could hold its own in our days of advancement, if it would compete with current market prices and leave a margin for its owner. Labor runs the cost of castings up, and the saving of labor brings it down. He who can save most in the production will profit most in his transactions. But labor can be performed either manually or by mechanical devices or by both means. Judicious selection, introduction, and application of labor-saving machines is the only solution of the problem of competing with others and drawing dividends from an investment.

The modern foundry includes in its equipment, sand conveyors, molding machines, sand mixers, drawboards, machines for cutting off sinking heads and gates, sand blasts, chipping tools, emery wheels, and a fully equipped chemical and physical laboratory. These appliances are of a great variety of construction, the maker of each one claiming special advantages over the products of his competitor. A great number of them are constructed to meet special requirements; most are adapted for special purposes, while few can be used for a general run of work within certain ranges, and hardly any advantage is offered to the jobbing foundry. In view of this we may ask the questions: Has this ground been fully canvassed? Have all improvements been made which can be made? Must we stick to our old fashion? Cannot we simplify present methods? Cannot we reduce our present expenses, and where could a saving be effected?

XUM

Let us take a walk through the foundry and see. We can naturally discover the faults of others and make comments on their shortcomings, though we may not be able to do better. Entering the yard, we happen to see a carload of pig iron unloading. There are five or six laborers at work, each one doing his share to hand out the pigs from the car, which others carry to the pile. This is slow work, costly and unsatisfactory. Right here we have room for improvement. There are certainly means to do this cheaper and easier; and if there are none, such means certainly can be provided. One would think that a simple overhead track, conveniently arranged with relation to the rails on the ground, and equipped with a hydraulic, pneumatic or electric hoist, which is especially adapted to the purpose, would replace all men but one to do the work quickly and cheaply.

Passing on, we see another gang unload a carload of molding sand; others wheel it into the foundry. Coke and sharp sand is handled in a like manner. No attempt is made, apparently, to save in the number of employes. They are certainly all old hands, and they must be supplied with some kind of a job. That is very considerate, indeed, but surely it is not very profitable. Why not get the sand in hopper cars, unload it with the aid of scoops, and transport it from its bins by a suitable conveyor to its destination? Why not provide similar modern labor saving appliances for handling the coke, and delivering this as well as the pig iron upon the charging platform? There is certainly too much time, too much labor and too much money wasted, before the materials have reached their place in the foundry. An army of men is employed, which can be dispensed with by judiciously selecting and introducing mechanical appliances to take their places.

We take a few steps further and lose our way in a labyrinth of flasks, justly thinking that the poor fellow who has to hunt for a few of a particular size must lose his courage at the beginning. Of course, they have accumulated for years. They are too valuable to be destroyed; they may be called for at any time, and even if a board or two are eventually rotten and have to be

replaced, it seems to be gratifying to live under the conviction that the right size may be on hand, if an odd job turns up unexpectedly. Does not the space required for their storage seem to be a waste of room, which might be made use of for a better purpose? Does it not appear as if, in such a quantity of flasks, a great amount of money is invested, which pays very little dividends? Is this really a necessary evil, for which we have no remedy? Apparently this question has not received proper attention from the foundry manager. It may be possible to devise some means to avoid the accumulation of such dead stock and, if this is accomplished, it is also possible to reduce the room for its storage.

I have here a little model of a flask, which by means of this little lumber pile, I will be able to change into flasks of 20 different sizes, in less time than it would ordinarily take to hunt for a flask of the required size.

Quite recently I had made a dozen sets of these flasks, which when assembled represent 72 full flasks, though they replace, in fact, 240 flasks of 20 different sizes. I have, therefore, reduced this particular flask pile exactly 66 2-3 per cent. I mention this matter merely to demonstrate one way of overcoming an apparently necessary evil, which may be an incentive to follow this matter up and lead to further improvements.

Now, let us step into the foundry itself, and see if we could suggest there any improvements. It is really well equipped. It has good cupolas, an electric traveling crane, sand riddles, sand and loam mixers, several good molding machines adapted to special, always recurring, work, sand conveyors and other appliances which are only found in the modern foundry. Each of these seems to suit its purpose admirably, and each has been carefully selected from among the best on the market. We dare not criticise. None but intelligent workmen, who are fully acquainted with all the details of these machines may be able to call our attention to some of their weak points—points, however, which may be profitably examined. Trifling improvements of factory appliances which suggest themselves during their service prove always of advantage to the manufacturer. The observ-

ing foundry manager, seeing his machines daily at work, will discover the shortcomings without his attention being called to them; and the progressive one, if he is not an engineer himself, will consult a mechanical engineer with the object of bringing his plant up to perfection. In some instances almost marvelous results have been obtained in molding with the aid of molding machines. The output of the foundry has been increased, and skilled men have been replaced by common labor. But so far there has not been constructed a really serviceable machine for a variety of articles as they occur daily in the jobbing foundry. Odd castings will always be molded by hand. Only where large quantities of the same articles are required again and again, is it profitable to apply patterns to a molding machine. And then the main feature in such machines will be always the withdrawing the patterns from the sand. The ramming of the flasks will have to be done in most instances partly by hand, though in some cases it may be admissible to accomplish this with the machine. The shape of the pattern will determine whether one or the other of these methods is preferable. The easiest and cheapest way to prepare patterns for the production of quantities with the aid of molding machines or drawboards is to secure them to plates, which are fitted accurately to their flasks. Each case, however, will require some ingenuity if satisfactory results are to be obtained. Molding machines in general are good labor-saving appliances in the foundry; they increase the output, and do not entirely dispense with the service of manual help. It is not likely that we will ever reach the point of building entirely automatic molding machines, which can be kept on a run of the same kind of casting, without the aid of human agency.

A modern foundry, with or without molding machines, is not complete unless it is equipped with a good system of sand conveyors. They deliver the molding sand automatically to the place where used. They dispense with the wheelbarrow, and, to a great extent, with the shovel. A great variety of these appliances are in daily use, all giving more or less good satisfaction. In selecting a conveyor for a new plant, preference should be given to a devise in which all moving parts are not subject to wear and

tear by friction and removed as far as possible from the sand itself. Hinges made of flexible material, such as leather or rubber, serving as connections for elevator buckets, scoops or trays give excellent satisfaction, and are in all cases preferable to metallic pin butt connections. What has been said about the delivery and distribution of molding sand is likewise applicable to the removal of burnt sand from the foundry. Labor is reduced in both instances, and the conveyor is an economical, reliable and untiring help in the foundry. Conveyors for the transportation of flasks, empty or molded, or molded and cast, are used in rare instances only. We have an excellent arrangement of this kind in our immediate neighborhood in the foundry of the Westinghouse Air Brake Works, at Wilmerding, Pa., which has been described in all periodicals paying attention to subjects of this nature; and I do not doubt that every member of the Pittsburg Foundrymen's Association had the pleasure of being entertained by Mr. Sleeth, and was given the opportunity of seeing the conveyor at work at the model plant he superintends. I will, therefore, not make the attempt of giving here again a detailed description of its working and of its construction. However, I will assert that the introduction of this or a similar system is equally advantageously applied in all foundries, producing castings in quantities within certain limits of weight.

This embraces about all that can be said in a general way about the present application of conveyors in foundries. To my knowledge, nothing successful has been used, so far, to convey the molten metal from the cupola to various parts of the foundry, unless a crane or hoist is employed for handling the large stock ladles. This, however, does not solve the problem. Ladles holding more than 100 pounds are carried as before by two or more men from the cupola to the flask, and here we have certainly room for improvement. When pouring-off time comes, the foundry is generally short of hands, and everybody in and around it is compelled to pitch in. This deficiency induced me to devise some means whereby each molder can handle his fluid metal without the aid of others, and I am just about ready to give it a test in the foundry forming part of the works where I

am engaged. It will give me much pleasure to report to you at some future opportunity how successful I have been in solving this problem. There is no doubt that if the scheme works, as I imagine it will, I will be able to reduce the cost of our castings considerably.

We will now once more go back to the subject of flasks which I mentioned above. Much valuable time is consumed in their selection, their preparation, and in their transportation to and from the foundry. And I am of the opinion that in each of these operations great savings can be effected by introducing and following some well worked out system.

Pneumatic hoists liberally distributed throughout a foundry will prove valuable savers of time for transporting, lifting, reversing, turning and closing the flasks, for transporting and setting heavy cores and for lifting and removing the castings from the foundry floor. The introduction of pneumatic hoists in a foundry furnishes another valuable accessory to the molder in placing at his disposal compressed air, which not only replaces his hand bellows for ordinary practice, but is also an easy means of cleaning patterns and stripping plates of molding machines.

The clamping of the flasks enters as another factor of cost in the production of castings, which to my mind is an unnecessary expense. Means should be devised to clamp the flasks more quickly than at present, and, at the same time at least as effectually as with the old-fashioned clamps and wedges. There are several kinds of improved screw and lever clamps in the market, any one of which is superior to the old hook and wedge clamp. It takes a molder ordinarily half an hour to clamp up his flasks for a day's heat, which time is partly lost in hunting for and selecting the right kind. A serviceable clamp forming part of a flask, which could not be lost and would always be ready for use, would be the ideal thing in the hands of the molder.

Cleaning barrels, which are known by some as rumblers, by others tumbling barrels or rattlers, are in extensive use in nearly all foundries. They should always be provided with exhaust pipes, to carry off the dust and burnt sand removed from the surface of the castings. They should be placed on a good founda-

tion, and protected by an outside shield or covering. They are always better outside the foundry than within. Many foundries rely upon the cleaning to improve the appearance of their castings by "running them through the mill." Rumbling, however, will not in all cases remove the molding or core sand sufficiently for tooling. Especially where castings are faced off or worked out with expensive milling, or complicated boring tools, it is advisable to put them through a pickling bath. Diluted sulphuric acid, which was used until quite recently for this purpose, has been replaced of late by hydrofluoric acid, which gives unquestionably better service. It is best to keep it in a lead-lined tank or box, which is provided inside with strong wooden lattice work. Neither wood, lead nor iron is appreciably attacked by the acid, while it actually dissolves the sand adhering to the castings. The wooden lattice work protects the lead from injury, and allows the sediment to drop below the false bottom of the bath. But a casting is not finished after it leaves the tumbling barrel. Gates and pins have to be chipped off to make a presentable piece of work. Sinking heads and gates of large castings are mostly cut off by circular saws, while hammer and chisel usually do the rest.

We have seen what extensive use we can make of compressed air in the foundry. And right here we have another application by replacing the ordinary hammer and chisel with pneumatic chipping tools. They accomplish about three or four times the amount of work which one man turns out in the old-fashioned manner. Though outrageously high-priced instruments, they will soon pay for themselves. The buyer apparently has to divide his profits effected by saving in labor, with the patentee or maker, or perhaps with both. These tools could unquestionably be made and sold for nearly one-third of the price for which they are sold at present; and if lower in price, they would not only sell larger quantities, but they would certainly be more universally introduced in all foundries.

A further valuable application of compressed air could be made by the installation of sand blast machinery for cleaning

castings. I have personally never seen one of these sand blast machines in use in a foundry, but I have seen them used successfully in glass factories, and the results obtained therefrom convince me that they are equally as good for cleaning castings. These samples, which I have cleaned by a primitive experimental contrivance of this nature, may give you a fair idea of the finish the sand blast puts on to the surface of rough castings, as it will also demonstrate to you the practicability of this method, if I add that the cleaning of this particular piece was accomplished in less than a minute.

Sand mixers constructed after the principle of centrifugal machines apparently give the best satisfaction. In selecting the right kind, attention should be paid to the minor details of construction. Its bearings should be well protected, so that no sand or dust can locate between the rotating parts and their journals. Its pulleys or driving mechanism should be conveniently arranged to suit each special case. A few years ago the writer met with some difficulties of this nature. A centrifugal sand mixer was purchased, and had to be erected. The only main shaft in the foundry was the one which transmitted power to the blast of the cupola and to an elevator. It was a continuation of the main shaft of the adjoining machine shop, which portion was kept running from morning till night, but the part in the foundry was kept running only when the blast or the elevator was required. Besides this, there was no convenient place for the mixer in the immediate neighborhood of the main shaft. Therefore a small rotary engine was coupled to the upper end of the central shaft of the mixer. Steam pipes were led to and from the same, and ever since it has worked admirably, never giving the least dissatisfaction. It stands isolated from the other machinery, at considerable distance from the nearest main shafting, and can be operated independently from other machineries, whenever its service is required.

The only subject remaining which requires mentioning in this paper is the chemical and physical laboratory, which though really not a part of the foundry proper, should always take the

first place in its equipment. Much has been said about it of late by men who are far better able to speak about it than myself. In referring you to the exhaustive literature on this subject, I will merely urge that the introduction of the laboratory should be carefully considered by all foundry managers, for I am convinced that it will unquestionably result in a profit for the manufacturer.

Finally, I wish to call your attention to a passage in the paper read at the last meeting by Mr. Paul Kreutzpointner, where mention is made of the segration of the various components in cooling liquid metal. The ordinary process of crystallization is well known to all, and what happens with liquid metal was so ably described in the paper and exhaustively discussed in the following debate, that it leaves no doubt such action of segration can be effectually prevented by pouring the metal at the lowest possible predetermined heat. To accomplish this readily and positively, we have but one resource, and that is by measuring its temperature. Several large foundries in Europe, among others Krupp, in Essen, Germany, have used the Le Chatelier pyrometer quite successfully for this purpose, and this instrument is just now being introduced for the same purpose in several of our progressive large foundries. We shall certainly hear in the nearest future of the results which have been obtained by its application, and we may expect that the pyrometer will find a prominent place among the latest and most useful of our foundry appliances.

The analyses of pig iron recently made by representative chemists, at the request of Thos. D. West, and reported in Mr. West's paper before this association, have aroused much interest among furnacemen, founders and iron analysts. Many letters have been received by the secretary commending the proposal for an arrangement by which standard drillings of iron can be secured by furnace chemists and others for checking purposes. The letters in some cases go generally into the considerations suggested by Mr. West's paper, covering the broad question of the causes of variations in pig iron. We give extracts below from a number of these letters:

F. E. Bachman, Buffalo Furnace Co., Buffalo, N. Y.: I thoroughly agree with Mr. West regarding the desirability of having a standard sample of cast iron from which we can draw when wanted. Regarding standard methods, there is a question, for the reason that absolute accuracy requires time and excessive labor. The results published by Mr. West are not results for chemists to be ashamed of by any means. The sulphur, phosphorus and manganese are the closest I have seen. The silicons vary more than they should in Tables 1 and 2. Of the carbons I will speak later. * * * Referring to the work of this laboratory: In making these analyses there was not one method used that we consider absolutely reliable without greater refinement, and on sulphur, phosphorus and manganese we would use entirely different methods if absolute accuracy were required. But in that case it would take three days to complete the work. I wonder if the foundrymen of the country would pay us the additional cost this would entail. My experience is that they are not willing to pay one cent more for Buffalo iron with silicon within one-fourth of one per cent of given analysis than they are for some irons coming from the valley district which I have known to have 1.75 per cent less silicon than represented. As to silicons, the results are not so bad as Mr. West seems to think. Every sample contained sand; possibly some of the sand had iron attached to it and got into the higher results. Probably some of the laboratories got their samples in good shape and did not go over this sample more than once to get it out. And then what difference will .27 per cent silicon make in a foundry iron where every bed has a variation, and there may be over 1 per cent variation in a cast and not one cast in ten has a less variation between the highest and lowest silicons reported. The sulphur, phosphorus, and manganese, with one or two exceptions, are all that could be expected, but we need a uniform sulphur standard and a more reliable sulphur method which can be worked accurately in not to exceed 30 minutes. A method which requires longer than that will be of no value. But even if this method is not obtainable, a standard which will retain the

smallest possible amount of sulphur in the insoluble residue and dissolve easily will be a godsend to iron chemists. Regarding the carbon determinations there is little to say. The results are abominable. I wonder whose fault it is. You would as well expect two chemists to agree on the iron in a sample of ore which had been passed through a one-inch mesh sieve as in a sample part of which lies on a 20 and passes an 80 mesh sieve. I venture to say not one laboratory in ten is prepared to make accurate carbons.

There is, therefore, a big opening here for a reliable standard and for a method applicable to furnace and foundry practice. Great care will be necessary in the preparation of this sample, to be sure there is no segregation. Pig iron would not do, as there are no two spots in the pig which are the same, and where you are dealing with 3.75 per cent to 4 per cent of a material which separates mechanically it is hard to get a mixture which is uniform and stays uniform where specific gravities vary. Not very long since we had occasion to check seven chemists on ferro-silicon and obtained results which we consider show careful, accurate work, viz.: Silicon, No. 1, 13.52 per cent; No. 2, 13.45 per cent; No. 3, 13.17 per cent; No. 4, 13.44 per cent; No. 5, 13.59 per cent; No. 6, 13.58 per cent; No. 7, 13.05 per cent.

F. Schumann, Philadelphia: I have read Mr. West's paper with interest and fully concur with him as to the desirability and need of some uniform method of analysis. I am aware that chemists and metallurgists are fully alive to these needs as evidenced by the activity of both national and international committees. Any one can realize the difficulties which lie in the way of the prompt adoption of uniform methods when he considers the great diversity of opinion that prevails even in so simple a question as the proper form of samples for physical tests. Mr. West's paper is most pertinent and opportune, coming as it does from one who has experienced the necessity of more uniform methods for direct application to the foundry business.

XUM

A. M. Robins, Cleveland: A "central standardizing laboratory" no doubt is much to be desired if it can be operated in a perfectly reliable manner. I am not sure but a monthly exchange of tests among a dozen operating chemists would accomplish the desired end. I realize the necessity of correct analytical work and would be glad to see measures taken to bring about a method of procuring such a result.

John M. McCandless, Atlanta, Ga.: I surmise that the object is to encourage an association of iron chemists so as to obtain uniformity of analytical results by adopting uniformity of methods. I can only say that this plan has worked well with the fertilizer chemists. Before the organization of the association of Official Agricultural Chemists, the discrepancies between the results of different chemists on the same sample were something startling. But since the adoption of uniform methods for estimating the "soluble reverted and insoluble" phosphoric acid, also the nitrogen and potash in commercial fertilizers, these discrepancies have to a very great extent disappeared, and there is no reason for differences on the same sample, and will be none, where the methods prescribed are faithfully carried out. In my belief, more variations are due to the use by chemists of certain "short cut" methods to the exclusion of the standard and well tried methods, than to any other one cause.

A. E. Outerbridge, Jr., Philadelphia: Mr. West's suggestions are good; at the same time I must say that I have thought that discrepancies such as he refers to, have been due to irregular sampling rather than to imperfect chemical manipulation. Some furnace proprietors observe more care in shipping iron corresponding to the analysis furnished with the invoice than others. In such cases I have often been surprised at the close agreement between the furnace analysis and "check" assays. In several cases that have occurred in the course of years where discrepancies have been sufficient to cause inquiry or complaint, investigations made at the furnaces have resulted invariably, in my experience, in explaining the matter on grounds other than that of fault in the analysis.

O. T. Stantial, Chicago: Having had quite a number of years' experience as chemist in laboratories of iron and steel works, I have oftentimes experienced the difficulties that Mr. West refers to, in obtaining correct check analyses by different chemists. The idea of establishing a central standardizing laboratory for the purpose of furnishing standardized drillings of cast iron, is, I believe, a move in the right direction, but I do not believe that it goes far enough to be of much practical benefit, except as a beginning to obtain more uniform results. In my opinion, a laboratory of this kind should not only furnish standardized drillings, but should furnish uniform methods of analyses and also standardized solutions and reagents and standardized materials.

The three tables of comparative analyses in Mr. West's article show such variation in each element that it would lead one to think some such scheme as Mr. West proposes should be adopted. Where such varied results are obtained by such able chemists as are the majority of those that made these analyses, it is not to be wondered at that no uniform results can be obtained by the average chemist.

Although not at present actively engaged in chemical work, I depend greatly upon chemical analyses in running mixtures of both gray and malleable iron and I believe it would be a great advantage to the iron industry to be able to obtain uniform analyses and results that can be entirely depended upon as correct, instead of the uncertain results that we occasionally meet with in general chemical work.

Asa W. Whitney, Philadelphia: I heartily approve of the suggestions made in Mr. West's paper. Of course there is much less demand for accuracy in some classes of work than in others; but until results check better than at present much doubt will exist as to where the error lies. But it will be found, after the most accurate agreement of methods is reached, that the one needful point is to know why a far greater variation is allowable in a well graded iron of one class than of another. I find that an accurate analysis is desirable in any sample and that it as truly

represents the lot as another accurate analysis of another fair sample, though the differences in the figures frequently exceed the differences due to methods, as shown in Mr. West's interesting paper. For instance, to bring grading by analysis to a practical degree of accuracy for all classes of cast iron, while the maximum accuracy of method in the laboratory is always desirable, the almost certain difference in samples of really well graded iron must be understood by buyers. And they should understand it to some such degree as it is understood by those who by careful figuring of mixtures can keep the same grade of output in any line of castings up to specifications far more rigid than pig iron grading and yet intentionally make greater changes in their chemical composition of cupola charge and casting than are to be found between most samples of well graded pig iron. Only by means of full analyses and careful, though simple, tests can this essential point be proved to foundrymen: That mixtures are more economically as well as more successfully managed without ocular inspection of pig metal than with it, if the real meaning of even a rough full analysis is known and its equivalent compositions are known.

Guy R. Johnson, Embreville, Tenn.: I highly approve of your proposition to establish a laboratory which will furnish standard drillings, but speaking from a chemical standpoint, I don't think that you go far enough. You may not be aware of the fact, but chemists are, that different quantities of elements for pig iron require different standards. The theoretical standard will not work out. For this reason, if such a laboratory was established, and by the way, such a laboratory would be a very profitable undertaking, in all probability, it would have to be prepared to furnish charcoal iron drillings for the charcoal iron furnaces, Bessemer iron drillings for the Bessemer furnaces, ordinary foundry iron drillings for furnaces making ordinary foundry iron, with phosphorus running from .50 to .75, etc. This, of course, would complicate the work considerably, but as every chemist with a practical knowledge of pig iron analyses will tell you, it is absolutely necessary.

This brings me to my one criticism on the plan proposed for getting the drillings. As you are well aware, ordinary foundry iron runs below .02 in sulphur (I am speaking now of Nos. 1 and 2). Your drillings having been passed through the cupola will have considerable more sulphur, probably up to .05 or .06, and this in itself would preclude the use of such drillings as you propose using, for standardizing solutions for sulphur analysis.

In regard to the difference in results: I beg to call your attention to one fact, which you have evidently missed, and that is, that the samples sent out to the various chemists contained, in at least two cases, both silica and scale. Making our analyses, we use a magnet, in the first place, and then methods for actual analysis, which would allow for the free silica. You can very readily see that the presence of either silica or scale, or both, would have a material effect on the resultant silicon analyses, and, indeed, this remark will apply to both phosphorus and manganese.

Albert Ladd Colby, South Bethlehem, Pa.: In this week's Iron Age you will find a critical review of this paper in which I have proven that Mr. West's samples were not uniform, so that the discrepancies in the different chemists' analyses cannot logically be used by him as an argument in support of his plan to establish and "maintain a central standardizing laboratory." I also state that the publication of such comparisons is unfair to chemists, especially when his avowed object was to compare the accuracy of analytical methods, and that such comparisons will only serve to unnecessarily prejudice foundrymen against chemistry. I cite an instance of greater difference in composition than his table of analyses show, occurring in the same cast of iron, and claim that non-representative and uniform methods of sampling have been the cause of much of the prejudice which has retarded the adoption of analytical chemistry as a basis of foundry mixtures. I appeal to the furnacemen and particularly to the foundryman who is the purchaser, and hence has the key to the situation in his hands, to first institute reforms in methods of sampling at furnace, and then by demanding check analyses rid the profession of care-

less workmen who can never be made into chemists by either standardized drillings or standard methods of analyses.

Although this proves clearly that Mr. West's suggestion will not entirely remove the cause of error which now retards the more general adoption of analytical chemistry, I am too keenly alive to the chemists' own shortcomings to adversely criticise any practical suggestion tending to aid the chemist in the improving of his analytical methods; and I heartily endorse Mr. West's suggestion of a cheap and convenient supply of standardized cast iron drillings or turnings, and think that the Pittsburg Foundrymen's Association might very properly appoint a committee to carry this idea up to the National or American Association, who would do well to set aside an appropriation for the careful preparation and analyses of such samples.

I do not endorse his idea of establishing and "maintaining a central standardizing laboratory." Such an expense is unnecessary, as the work can be taken up as an adjunct at some laboratory where it will receive careful supervision, and where chemists can buy the standardized samples. Six analyses should be made on each sample. If desirable, one set of analyses may be made at this laboratory, but at least two should be made by American members of the International Committee on Standard Methods of Iron and Steel Analyses, and the remainder by laboratories connected with prominent iron and steel works.

R. S. MacPherran, Milwaukee, Wis.: There have been a great many analyses tables published, some showing greater variations in sulphur and phosphorus than those of Mr. West, but none I have seen where the differences were so great in carbon. Could not this have been due, in part, at least, to the condition of the sample? It would be difficult to so mix a large quantity of drillings as to give each sample its proper proportion of graphite. In the event of future samples being prepared, pardon my suggesting that what is called a "shot sample" of cupola metal be taken, pounded up and put through a 100-mesh sieve. The carbon will be nearly all combined, the material finely divided and more uniform samples obtained. As to the uncertainty of one

laboratory checking the results from another, this may be regarded by a practical foundryman with a laboratory at his disposal from two standpoints: 1. As it affects his buying iron; 2. As it affects his using it. There is always more or less friction between buyer and seller and a series of standards such as suggested, would be of great value in disputed cases. It would also lessen the number of disputes, by making more uniform the results from different laboratories.

In using the iron, the ordinary "variations" of a chemist, if consistent, do not seriously affect the value of his analyses when applied to making mixtures. For example: Castings show a certain loss or gain in the various elements, as compared with the pig iron charged. The results of two men, both the castings and pig iron being analyzed by each, should show the same loss or gain. For the methods used and the personal factors will apply to the results on both the castings and pig iron. The ratio of the analyses should be the same. For use, though absoluteness of results should be and is the object of all chemists, consistency is nearly as important. I do not wish to be understood as upholding careless and inaccurate work, but merely to express the belief that when ordinary care and methods are used, the determinations obtained, while perhaps not absolutely correct, will give satisfactory and recurrent results when applied to cupola practice.

S. S. Knight, Springfield, O.: The plan Mr. West sets forth seems to me to be one of great practicability and merit and undoubtedly would do much toward securing more uniform results in the analysis of cast iron. It seems impossible, however, that this end could be fully attained without the adoption of some standard method of procedure for each and every determination. I would respectfully suggest, therefore, that the association, if it should see the matter in the same light, consider the advisability of appointing a committee to investigate thoroughly as to the probable utility of such standardizing and the adoption of such standard methods as may seem to them to be best.

James C. Foster, Sheffield, Ala.: I heartily co-operate with Mr. West in his work and think it a step well taken. When

checked by other chemists and considerable variance found, which is often the case, it is a poor explanation, gives little satisfaction and is rather embarrassing to the chemist to say that he uses a different method. This plan should give us a check against something definite and therefore add greatly to the uniformity of the results.

J. M. Camp, Duquesne, Pa.: I wish to enter my protest to Mr. West's deductions from the results of the analyses of three samples of iron distributed by him. That the drillings contained sand is beyond question, and I believe I was the first to notify him on this point. That the drillings are also very irregular has also been proven here, aside from the results he reported. On separating the coarse from the fine, very widely divergent results were obtained on phosphorus, particularly on the two samples of foundry and charcoal irons.

I agree perfectly with Mr. Colby's criticism of Mr. West's paper. I can also add that the best argument for the scientific control of the foundry is the every-day practice of a modern blast furnace and steel works plant, where from the analyses of all the raw material entering the furnace, theoretical mixtures are made up that agree within a few thousandths of one per cent of the actual resulting iron of the controllable elements. From the iron, still fluid, steel is made, and so thoroughly is the concentration, increase or loss of each element known, that the resultant steel is as sure as fate and taxes. Standard drillings are of inestimable value at times, but their preparation is as important as the analysis. They should be of about one size, for instance such as would go through a 10-mesh sieve and stay on a 20, free from dust and all foreign matter.

Prof. C. H. Benjamin, Cleveland: I approve heartily of Mr. West's project of a central laboratory for furnishing standardized drillings and deem it the cheapest and best way of securing uniformity. I have consulted with Prof. A. W. Smith, who has charge of the metallurgical work here, and we are agreed that if it is desired such work can be done at Case School in such a way

as to make the standards authoritative and above suspicion, and at as low a cost as anywhere.

W. L. Watt, Kittanning, Pa.: Referring to the suggestion of establishing a "central standardizing laboratory" in this, the Pittsburg, district, in my opinion it is a splendid idea, and bound to be productive of good results. Please count on me if I can be of any service, or assist in any way.

Guy R. Johnson, Embreville, Tenn.: I feel sure that Mr. West's project for central laboratory can be made a financial success, for the simple reason that every laboratory in the country has to have standardized drillings, and I can say, from bitter experience, that such drillings are a very expensive necessity.

Rogers, Brown & Co., Cincinnati: We have noticed a paper by Mr. Thos. D. West in regard to analyses of pig iron, and we understand that this paper is to be discussed at a future meeting of your association. Kindly pardon us if we seem to intrude, but we consider the matter of great importance to iron producers, users and the selling agents also. We have found a decided variation in the results obtained by different chemists who were said to be competent; and in some cases they have attributed the difference to the fact that they did not use similar methods in their work. We do not suppose that identical results will be obtained, but it seems that it would be very much more satisfactory if the chemists themselves would determine which methods are most likely to produce accurate results, and then have these methods adopted by all of those who make a specialty of iron, steel, coke, ore, etc.

We expect considerable variations when different samples are taken, even if they come from the same carload of material; but there should not be the wide differences that exist in determinations of the same sample by chemists of high standing. If the Pittsburg Foundrymen's Association can assist in the good work that has been started by Mr. West, they will deserve the thanks of the entire iron trade.

John P. Griffith, Mancelona, Mich.: In my twelve years' experience, I have more than once found the need of a reliable

standard, and almost persuaded Bullock & Crenshaw, Arch street, Philadelphia, Pa., about six years ago, to supply their customers with various standards. The scheme fell through, but not through any fault of mine. As you are probably aware, we cater to the malleable iron trade, and practically guarantee our iron, an analysis accompanying each car. We have had several "scraps" on sulphur, and on calling in a third party, they have always substantiated the results obtained at the furnace. I merely mention this, as it proves the correctness of Mr. West's views, viz., that a great deal depends on the method used. I hope the sentiment of the profession may be favorable to a "central standardizing laboratory."

S. B. Marshall, Dunbar, Pa.: I read with much interest Mr. Thos. D. West's article in reference to the establishment of a "central standardizing laboratory." He asked that the chemists, etc., respond with their ideas. I certainly think it would be a good plan if these samples were to be standardized by the mean result of a great number of chemists who had analyzed portions of them. In that way these great differences in the analyses would in a measure be stopped. I take a great interest in anything connected with the foundry and iron trade, as we are producers of special brands of foundry iron, also forge and basic.

The Thomas Iron Co., Hokendauqua, Pa.: We are thoroughly convinced of the benefits to be obtained from having access to absolutely correct standards. We consider that the work that already has been done and that which is still to be done by the Committee on International Standards will result to the great benefit of all. So much depends on the uniformity of the samples on which checks are to be run that we think too much care cannot be given to the matter of sampling. Our samples of the drillings sent out by Mr. West contained sand and we were advised by Mr. West of this fact and requested to remove the sand. The samples sent out were not carefully prepared, uniform samples.

Dr. Wm. B. Phillips, Birmingham, Ala.: What is needed particularly is uniform methods in the analysis of iron and steel.

Standard samples are, of course, excellent things in their way, but they do not cover the ground as I see it. Rigid analytical methods to be adopted and used by all who are engaged in the foundry trade, whether as producers of iron or manufacturers of castings, are the really essential demands of the situation. I have had occasion of late to look very carefully into the question of methods as applied to the sale and use of bauxite from Georgia and Alabama for alum making. For the last several years there has been more or less friction between the miners and the manufacturers as to the content of alumina, and the differences have been due almost entirely to the differences in the analytical methods employed for the estimation of the alumina which is of value in alum making. Until the miners and the manufacturers can agree upon a common method there will always be trouble. The alum business is, of course, a small thing as compared with the foundry trade, but the principle governing identity of analytical results is the same. For the last 20 years the official agricultural chemists have been fighting the battle of uniform methods until at last, through the Association of Official Chemists, the methods adopted are made obligatory. All of the fertilizers and fertilizing materials sold in the United States are subject to inspection and analysis by the chemists of the various States, and all the chemists use the same methods. The results are not always satisfactory, for after all there remains the personal equation to be reckoned with, but they are far more satisfactory than they were twenty years ago, or even ten years ago. There is no such thing as perfect satisfaction, and can not be so long as we have to deal with imperfect human nature.

But the first step towards greater satisfaction in the iron trade, as it was in the fertilizer trade, is to adopt uniform methods of analysis, preceded by uniform methods of sampling. I regard the sampling of material as the most important thing in connection with the whole subject. As a rule, the chemists may be relied upon to make accurate returns of the composition of samples submitted to them, and discrepancies in results are due, for the most part, to discrepancies in the samples. Chemists seldom have any-

thing to do with the sampling of material sent to them for analysis, and yet when discordant results are obtained from what some one or other says are identical samples the chemist is blamed. The so-called practical men assume that the only persons around the plant who make mistakes are the chemists and that they themselves are infallible. The fact is, that the taking of samples, which is ordinarily regarded as of minor importance, is really of the greatest importance and outweighs the mere performance of the analysis. The analysis may and doubtless does represent the sample but what does the sample represent? No trustworthy deductions can be made from the analysis, no matter who makes it, until it is known that it correctly represents the material under discussion.

In my opinion the first thing for the Foundrymen's Association to do is to agree upon a uniform method of sampling pig iron and castings, and then to agree upon a uniform method of analysis. If this association proposes to enter upon the subject of chemical control of the iron and the products, it can do so only in this way, for it is useless to analyze samples that represent nothing. The establishment of a central laboratory is an excellent idea and should be carried out; but if it be not preceded by rigid requirements as to sampling, the results from it will not command the attention and the confidence we naturally desire. If the association is to go into this thing it should do so properly or not at all, and should realize fully the logical consequences of the step it is about to take. No half-hearted measures will be of much value either to the producer of foundry iron or the consumer.

In this part of the country the producers are averse to the sale of ordinary grades of iron on analysis, and this too in spite of the fact that the granulations, fracture, color, etc., of the iron are no longer a reliable indication of its composition. They realize this and yet are almost a unit against the sale of the iron on the only basis that can maintain. These irons cannot be correctly graded in the yard. Every one sees this and yet no one is willing to offer the iron to the trade on its merits. The consumers of this iron

have the remedy entirely in their own hands, for the foundation of the foundry trade is in the cast-house. If foundrymen should insist upon the purchase of iron on analysis one of the greatest steps towards uniformity in the trade would be taken.

A REVIEW OF THE FOUNDRY LITERATURE OF THE MONTH.

AMERICAN MACHINIST.

Oberlin Smith has the following in the issue of May 19 on "Pickling Castings:"

I should be glad to hear an expression of opinion from some of your correspondents in regard to the advisability of pickling machinery castings of moderate size, say under 1,000 pounds in weight. Remarks as to the methods might also be of interest to some expectant picklers.

The advantages of such pickling are, of course, the getting rid of sand which would otherwise have to be rubbed off or left on, and the removal of hard scale to prevent damage to cutting tools.

The disadvantage of pickling lies chiefly in the expense of the process; also, in some cases, in the fact that the surface of the iron does not hold the paint so well, although this, of course, is chiefly due to imperfect cleaning off of the acid.

In my own practice of many years I have been through various phases of the pickling fever, at times feeling inclined to perform the operation upon every casting that came into the shop, sometimes going up to a ton in weight, and at other times going to an opposite extreme, and pickling nothing. For very small castings, tumbling is doubtless a cheap substitute for pickling. For larger ones, the present most usual practice would seem to dispense with it altogether, for the sake of saving the expense, bother and delay. There are, however, many cases where tools, especially those of an expensive character like milling cutters, can be made to last much longer and maintain keener edges if the iron has been thoroughly pickled and entirely freed of hard scale.

Just where to draw the line in regard to these matters is a question that many of us would like to have answered, partly by getting the benefit of other people's experience. Hence this inquiry.

IRON AGE.

Albert Ladd Colby writes the following letter to this paper on the topic of "How to Secure Uniformity in Pig Iron Analyses:"

"I am pleased to note from Mr. West's comments in your issue of the 28th ult. on my criticism of his paper, 'Need of Greater Uniformity in Pig Iron Analyses,' which appeared in The Iron Age of April 21, (see May Journal.—Ed.) that he admits that there is no question but that less variation would have been shown in the chemists' results if his three samples had each been more carefully prepared.

"I did not claim that the non-uniformity of the samples was a source of error which should have been avoided, as his avowed object when first distributing the samples to the chemists was a comparison of the analytical methods used, although he has since explained that his object was to determine the variation of every-day practice of rapid working on ordinary pig drillings.

"Among the letters sent to the secretary of the Pittsburg Foundrymen's Association and to Mr. West, in discussion of his paper, there were many who agreed with my criticism in attributing some of the variation in analyses, especially silicon and graphite, to the irregularity of the samples.

"There is nothing in my criticism of his paper which would lead a careful reader to believe that there was very little or no difference in the methods used by chemists over our broad land, or that perfection had been attained in establishing uniform methods. On the contrary, I stated that I was too keenly alive to the chemist's own shortcomings to adversely criticise any practical suggestion tending to aid the chemist in the improvement of his analytical methods, and I heartily indorse Mr. West's idea of establishing a cheap supply of standardized samples.

"Mr. West fails to perceive wherein my illustration of the variation in composition of different beds of a cast of iron has any relation to his sample of drillings from a piece of pig iron 9 inches long, which he states by reason of its short length must necessarily effect the closest uniformity of the metalloids in the drill-

ings sent out to the various chemists. The context shows I cited this variation in a cast of iron to illustrate the importance in routine work of representative sampling, and I cited the variation in graphite in different sized drillings of a sample to show that even after selecting a representative sample accurate chemical work could easily be wasted if care were not taken to obtain uniformly fine drillings, which can readily be done by a blunt drill and slow feed.

"I am pleased to learn that the Pittsburg Foundrymen's Association has appointed a committee to bring up, at the June meeting of the American Foundrymen's Association in Cincinnati, the subject of a cheap supply of standardized drillings to aid in testing the accuracy of chemists' methods. I hope the association will also recommend that furnacemen be required to take representative samples of every cast of iron analyzed, for without such samples the increased accuracy in chemical work which will result from Mr. West's standardized drillings will be wasted.

"Both reforms, more representative sampling and more accurate chemical work, are necessary to accomplish Mr. West's admirable object—the more general adoption of chemical analyses as a basis of foundry mixtures."

This journal says editorially of "Bessemer Pig Iron in the Foundry Trade":

The presumption is quite natural that Bessemer pig iron is produced exclusively for the manufacture of steel. Even in otherwise well informed circles the belief is prevalent that, with the exception of a comparatively small quantity used in making ingot molds, all Bessemer pig iron is destined for steel works. Yet in the past five years our columns have borne frequent references to the increasing consumption of coke Bessemer pig iron in the production of malleable castings. This is a feature of the trade which should not be overlooked. It is far more important this year than ever before, owing to the unprecedented demand for malleable castings. Should the malleable iron trade continue to expand as it has done in the past two or three years, it will be of material assistance in strengthening the market for

Bessemer pig iron. Car wheel manufacturers are also paying their respects to the same class of iron, some of the most prominent makers asserting that they are able to secure thoroughly satisfactory results from its use. Charcoal iron continues to claim a share of the trade in these branches, but coke Bessemer is far in the lead and from present appearances will reap most of the benefit of their expansion.

THE FOUNDRY.

In "Notes from the Orient," some of the difficulties to be encountered in establishing a trade with the population in that part of the world, are dwelt upon. The following from the article will tend to show the state of the foundry business in the eastern empires:

The foundries about Yokohoma, Tokio, Osaka and Nagasaki, the four most populous districts of Japan, are numerous, but small affairs. There are exceptions, but they are very few. Even these are not large foundries, but keep a number of small concerns to whom they sub-let their work. The small foundries are cast broadcast throughout the cities and in the back country, covering pieces of ground from 40 to 50 feet square, using from 30 to 200 tons per year, and buying at a time only enough for the immediate work. They make anything that is small, mostly kettles, pans, culinary articles, and repair work for machinery. The few larger plants in the cities make the engines, pumps and large machinery parts. The small concerns consume the greater part of the iron that comes into Japan. It must be prepared for them and taken usually some distance from the seacoast. The peddling business is done in this way: The pigs are all broken up into small pieces of about 3-inch cubes, packed in bags of 100 pounds each and shipped for miles throughout the country. The breaking up is necessary on account of the small cupolas, lack of wind power, coke, and also to facilitate shipment. The cupolas are all very small, ranging from 12 inches to 24 inches, occasionally 30 inches. They are portable, built up in sections about 8 to 10 feet high, standing in the foundry like a stove. All the

coke and iron is thrown over the top, and after the heat the cupola is taken down and cleaned. The wind is forced in by bellows worked by hand or foot-power, and the coke used is very poor in quality. All this make it necessary to have the iron easily melted and in small pieces. The foundrymen are poor and have no credit with the foreigners, and nine-tenths of the firms have no name and their ownership is unknown. They buy their iron in lots of from 100 to 500 pounds at a time, and for this amount are given credit by the merchant. They will not deal with foreigners. In fact, no business is ever done with a Japanese consumer, which makes it necessary for the middleman or merchant to come between the importer and consumer. These middlemen are closely allied to each other. From Yokohoma to Nagasaki they are formed into a guild or combination, and their point seems to be to get ahead of the foreigner. These men buy the iron, break it up, distribute it, and as they allow a certain amount of credit to the consumer, control him.

What "K. K." calls a "Brass Foundry Incident" only brings to mind the fact that sometimes things work in the opposite direction from that which they are, according to all rules and regulations, expected to take. The trend of the article may be observed from the following:

The apprentice boy at Caster's brass foundry had made a discovery that surprised and puzzled him, and incidentally Caster also.

It was in this wise, he (the apprentice, I mean), had been making some brass knobs two and a half inches in diameter; they were cored out to 3-32″ in thickness and were used to decorate the railing, that kept visitors from getting tangled up in the working parts of the big engines, built by the firm.

A small V-shaped gate, the size of one's finger-tip was used to run them, and the sprue was an inch in thickness and about four inches in height.

The apprentice had made hundreds of them, and never had any trouble nor did he have any trouble on this occasion, only he forgot the cores in one of the molds, and when he came to

shake out, he discovered that, and was surprised, not only at having forgotten his cores, but at the appearance of the castings.

As knobs they were certainly bad, not having cores, but as castings, they were good, and this is what puzzled him.

If they had been wanted solid, Caster's way—and everything had to be done his way—would have been to put on a large gate, heavy sprue about 5 inches in height, and pour cool, and he would not have expected to get them in any other way; nor would the apprentice, as, of course, he only knew what Caster had told him.

But here they were, and Caster, when he had examined them well, remarked that it was "funny" what a difference hot metal could make. Poured cool, those things would have been flat on top with that gate and head.

Unimportant as the incident was, it was not without results, for a day or two after, when "Tramp" made a couple of heavy boxes and lost them by shrinkage, Caster, according to his habit, said he thought the metal had been hot enough, and was going on further, but suddenly recollected something, checked himself and said in a resigned tone, "Well, we'll have to try them a little hotter next time," which they did and got them all right, and so "Tramp" was absolved from blame, as Caster always regulated the heat of the metal.

Writing of "Foundry Office Work" a "foundry clerk" says: In the malleable trade, the shipping, weighing and receiving is a department by itself. Whatever product is brought into the shipping room is assorted, counted and packed up in barrels or left in loose lots. The shipper is guided by his order book, which is lined up in such a way, that on the left hand appears the customer's name and the items which form the order, on the opposite page the items are entered in the same way, with plenty of room left, for the checking of shipments.

After the castings are sorted and counted, the clerk will enter the items in the shipping book, and if in barrels give the number of the barrel, or if in loose lots mark it loose lot or lots, afterwards the castings are weighed, and the weight also entered in

the shipping book, the customer's name always stands at the head of the entry in the shipping book. Every night the shipments are reported for entry into the sales book. Whatever may be received by the shipping department is recorded, and an extra book is kept for things received by car or vessel loads, as a consequence the receiver is the proper person to whom all incoming bills are given for checking.

In "Cast Iron Notes" Mr. W. J. Keep presents an answer to the following questions:

Hard Castings.

"Would you mind expressing your views on the following analysis:

"Graphitic carbon 2.82, combined carbon 0.71, silicon 2.70, sulphur 0.06, phosphorus 0.61, manganese 0.12. I find this mixture rather hard to tool in the machine shop. Perhaps the combined carbon is too high. If so, what would you do to remedy same, or perhaps some of the other ingredients might be higher or lower."

A casting of this composition ought to give no trouble in the machine shop. I take for granted that the castings are pulleys and ordinary machine castings.

The pig iron scrap and fuel were exceptionally good to have produced a casting of this composition.

If a certain chemical composition could be relied upon to produce a corresponding physical structure, there would be no fault with this mixture. The hardness must have resulted from a hardness in the original scrap used with the pig, or with the pig iron itself.

To soften and to reduce the combined carbon add to the mixture a little of some good softener, a pig iron containing, say 4 to 6 per cent of silicon to 1.50 per cent of phosphorus.

Probably by throwing out some of the hard pieces of scrap iron the present mixture would be perfectly satisfactory.

Mixture for Chilled Car Wheels.

"Will you be so kind as to give me a good mixture of iron for chilled car wheels?"

It would do you no good to give you names of pig irons that would make good car wheels, because the broker from whom you purchase pig iron sells you good car wheel iron.

From the location of the postmark the writer is not likely to engage in the manufacture of chilled car wheels. If already in the business he would not have asked the question.

If it is desired to make a few small car wheels, use old car wheels for one-half of the mixture and soften by adding No. 3 foundry iron.

Molding Sand.

A sample of sand is sent in a small box. The lump is so hard that it cannot be broken with the fingers and the color is quite red. The question was, "How does this compare with the leading machinery sands throughout the United States, and will it be good for all kinds of jobbing work?"

The sand is not at all suitable for use as a molding sand. The red color comes from a large quantity of iron, which is not a desirable addition to molding sand. It contains too much clay for a good sand and is too fine for machinery. Perhaps good sand cannot be found in that locality, and it may cost too much to take good sand there. If so, find a yellow, sharp sand and mix the two until the resulting mixture has the required strength and openness.

Semi-Steel Castings.

What are they, and how are they made?

They are ordinary cast iron castings, to which is added in the cupola steel chips from boiler plate. To make the castings solid a small quantity of pure aluminum is added to the ladle. Small pieces of ferro silicon placed in the ladle will often accomplish the same thing. The adding of steel scrap to cast iron is not a new thing, but has been used in England and in this country for many years. The addition of aluminum or silicon to the ladle to insure soundness and to increase fluidity is comparatively modern and is necessary to success.

The strength is due, not to a chemical change, but to the mechanical mixture of the steel throughout the casting. This is

shown by the fact that a second remelting which makes the mixture more perfect shows much less strength.

In a late discussion of this subject, Mr. Geo. Mattison said that two of the prominent Detroit founders purchased the right to use the McDowell process for making semi-steel. He says that this mixture consists of ordinary cast iron and scrap steel plate, melted together in the cupola, and in the bottom of the ladle is added a very small quantity of aluminum alloy, consisting of 80 parts of iron and 20 parts of aluminum. He says the usual transverse strength is 3,000 pounds measured on bars one inch square and twelve inches between supports. The strength can easily be increased to 3,500 pounds by adding more steel scrap. The 3,000-pound metal is but little harder to work than ordinary good cast iron which possesses a transverse strength of 2,000 to 2,500 pounds.

The 3,500-pound metal is somewhat harder on the tools than cast iron, but not hard enough to cause difficulties of any kind. The price is but little greater than of cast iron, as steel scrap can be bought cheaper. In fact, considering the increased strength, semi-steel certainly does not cost any more than cast iron. These firms use it whenever a reliable and strong casting is wanted. The fracture of semi-steel is very close grained and uniform, and presents an excellent wearing surface when finished.

IRON TRADE REVIEW.

This journal says editorially of "Standards for Foundry and Furnace:"

One very evident result of the foundry association regime of the past five years is the movement for a better understanding between the foundryman and the maker of his pig iron. There is no question that the steel maker, with his thorough dependence upon chemistry, and his more exacting requirements of the furnaceman, has done much to make the laboratory an important adjunct of the blast furnace. In the past few years the foundryman has caught something of the spirit of the steel works and has been telling the furnaceman what sort of iron he wants,

instead of relying upon the pig iron salesman to make his mixture or when he is in trouble, to find him the brand of iron that will work a cure. There has been a disposition on the part of some pig iron selling firms to look upon the foundry association, with its flood of foundry literature and discussion, as a disturber of existing relations between buyer and seller of foundry iron. Not that the furnace is unwilling to furnish what the foundryman calls for, if he knows what he wants and why he wants it, but it has been found in some cases that lack of thorough knowledge has caused no little trouble. The doctrine has been pretty generally preached that the old procedure has been haphazard and unscientific; but the foundry world in general has not come into a full mastery of the new.

Grading and making mixtures by fracture and grain have been proved unreliable; but the average foundry, with no chemist of its own and not yet educated to the point of occasionally going to the chemist for help about its mixture, is not in position to make use of the analysis card which it has become more and more the fashion to ask the furnace to send with each shipment. And the furnaces, knowing that in many cases the foundry has no arrangement for checking their chemical determinations, have not been in haste to carry into the manufacture and grading of foundry iron the accurate methods that belong to their Bessemer practice.

But it is not difficult to see that the chemist as an adjunct of the founder, and a guarantor against the unexpected in his castings, is much more of a factor to-day than five years ago. He has demonstrated his value in this capacity. A score of important foundries could be named who would make ready acknowledgment of the money value of the chemist's services. Yet chemists, like doctors, disagree, and this fact has had its influence, doubtless, in retarding the movement toward a more scientific basis for making and controlling foundry mixtures. On other pages of this issue are letters (see Proceedings of the Pittsburg Foundrymen's Association in this issue.—Ed. Journal) from chemists and metallurgists, commenting on the reasons for

the variations in results shown in the tables of pig iron analyses, recently presented by Mr. West in a paper before the Pittsburg Foundrymen's Association. It will be seen that there is some disposition to attribute the differences to improper sampling, and yet there is such agreement on the need of more uniformity in chemists' methods as to make a strong endorsement of the proposal of Mr. West.

Coming from a foundryman, Mr. West's proposition naturally does not relate to analytic methods. On this question iron and steel chemists have already taken the initiative. But the preparation of standard samples of cast iron, from which chemists could secure drillings to check their methods, is a desideratum of foundrymen, chemists and metallurgists, and in supplying the need there will undoubtedly be the most ready co-operation. The unanimity with which chemists working in iron and steel have endorsed the proposal, and the favorable attitude of the Pittsburg Foundrymen's Association give indication of the reception the plan will have in other quarters. Its execution will be an important step toward harmonious action by foundries and furnaces in the new movement for scientific foundry practice. The elimination of hap and uncertainty from operations with foundry iron is an object well worth all that the educational movement of the past five years has cost, and all that will be involved in the carrying out of present plans.

Writing to the Iron Trade Review an eastern foundryman says:

"I have been much interested in Major McDowell's recent paper and the discussion by the Western Foundrymen's Association. I have a very peculiar case in hand, and if you will bring it before the association perhaps some of its members can explain the matter.

"We have a No. 2 pig iron of the following analysis: Graphitic carbon, 3.25; combined carbon, .25; silicon, 2.50 to 2.75; phosphorus, .60 to .70; sulphur, .015 to .03; manganese, .50 to .60. We have used a large amount of this iron with the best of results in combination with a high silicon iron, a strengthening

iron, and about 50 per cent of foundry and railroad scrap combined. We have just got a sample car of the same grade, but a No. 3 iron, graded by fracture. The analysis of this special car is as follows: Graphitic carbon, 3.40; combined carbon, .30; silicon, 2.56; phosphorus, .51; sulphur, .032; manganese, .45. The furnaceman states that this may be a little above the average for their No. 3 iron, in silicon. The analysis of the No. 2 iron I have taken from the cards of a number of cars, and give the limits of the variations in the metalloids. On starting to make up a charge of this iron, I was at a loss to know exactly what to do with the No. 3 iron. It seems to be in all respects the same as a No. 2, with the exception of the combined carbon, total carbon and fracture. The variations in the phosphorus, sulphur, and manganese don't seem to me to be enough to have a sufficient effect on results to be noticeable.

"Mr. West, I notice, claimed that carbon can be ignored entirely in considering iron analyses. Major McDowell claimed that with irons that varied in silicon and manganese he could make a composition for any desired purpose. If the carbon has no effect, it would seem to me we could use a No. 3 iron in place of the No. 2, and make quite a little saving in cost, but if this is the case, I don't understand why the fracture of the No. 2 should show so much higher percentage of graphitic carbon crystals, and also larger ones. There is a marked difference between the two.

"Tables which I find in a reliable work show the following percentages of silicon and combined carbon for maximum strength, etc.:

Silicon for maximum hardness, 0.80 per cent.
Silicon for maximum crushing strength, 0.80 per cent.
Silicon for maximum modulus of elasticity, 1 per cent.
Silicon for maximum density, 1 per cent.
Silicon for maximum transverse strength, 1.40 per cent.
Silicon for maximum tensile strength, 1.80 per cent.
Silicon for best softness and working qualities, 2.50 per cent.
Combined carbon for maximum crushing strength, 1 per cent.
Combined carbon for maximum trans. strength, 0.70 per cent.

Combined carbon for maximum tensile strength, 0.47 per cent.
Combined carbon for soft castings, 0.15 per cent.
Combined carbon for extra soft castings, 0.08 per cent.

"The point is, concerning the irons we have in hand, what effect does the high combined carbon have on the high silicon, and which is the better to go by, chemical analysis or fracture? We have a third iron, which is classed as strong pig, whose analysis is as follows:

Graphitic carbon	3.41
Combined carbon	.15
Silicon	1.87
Phosphorus	.60
Sulphur	.021
Manganese	.60

"I presume that the claim of strength rests on the combination of low silicon and low combined carbon. I should like to hear what foundrymen have to say in regard to strong irons, and how they differ from other irons."

In the following issue Mr. West writes the following, partly in reply to the above:

The article by a New York foundryman in your last issue, quoting one of the writer's recent statements, calls for correction. I did not claim that carbon could be ignored in the sense referred to. I claimed that the state of the carbon, whether graphitic or combined in pig metal, was not necessary to be known. The tables on the physical qualities of iron cited by your correspondent are of little value. In order that these might be used for any practical purpose, the percentages of all the metalloids, especially the sulphur and manganese, are necessary, as well as the silicon, which was shown. The table indicating the effect of combined carbon is also in error. If, in this the percentage of the graphitic carbon had also been stated, the tables would offer some practical assistance in enabling one to judge whether the percentages of combined carbon stated would be

effective in giving the results shown in other duplicate work. The work these tables were taken from might be reliable in other matters, but on the matter at issue it is certainly not correct. Such tables are not to be written in that form.

In a letter to this journal Mr. West has the following reply to some of the criticisms which have appeared on his proposition to establish a central laboratory for furnishing standardized drillings for iron analyses.

In view of the letters recently written by chemists and metallurgists concerning a central laboratory for furnishing standard drillings for iron analyses, permit me to add a few lines to my original paper on this subject. Some seem to think I should have sent out specially prepared drillings, such as were referred to as essential for standardizing purposes. Such a course would not have demonstrated the results of actual practice. When a founder or furnaceman desires to check pig iron analyses, he does not have uniform and clean drillings with which to do it. He is compelled to use such as he may procure from the pig metal as it comes to his yard. All pig drillings are liable to contain some sand or grit, which, as a rule, is taken out of the account by the use of the magnet before analysis. And again, no attention is paid to uniformity in the size of drillings. In order to conform with this general practice I sent the drillings out with a request to remove any sand that might be found. It has been claimed that the difference in results shown in the paper was not due to non-uniformity of methods, but to the drillings having sand in them. As indicating whether there are grounds for such claims, let me call attention to the fact that where a chemist is low in silicon with one class of iron, he is as a rule, low or not far off in the other two, or vice versa. As an example of such checking, see Laboratories A and P, the first and last of the three tables shown.

It was partly to show how methods check one against another that drillings were given of the three different classes of iron shown, and I believe a study of this feature of the paper will

lessen the stress some have put on the method of sampling the pig drillings as the cause of the variations shown.

I think it is fair to conclude that the analyses given in the paper read at Pittsburg indicate what a founder may expect, who, having worked after one chemist's method in making his mixtures, is brought under the different method of another chemist. The paper shows that such a change might be very injurious to the trade of both furnaceman and founder. Some are of the opinion that the paper does not go far enough. It is true, much more might have been suggested, but it was thought best to start on a small scale, as such a course would make success the surer in developing larger fields of work. If anything had been said directly about working for uniform methods in analysis, the paper would have been criticized as assuming to deal with what belongs to the chemists themselves. I believe that establishing an agency for furnishing clean, uniform standardized drillings at moderate cost, will do more to bring about uniform methods than any other one thing that could be suggested, and I am pleased to note the great interest all manifest in the attainment of this end. I am also pleased with the action of the Pittsburg Foundrymen's Association in appointing a committee to carry this work up to the American Foundrymen's Association convention which meets in Cincinnati, June 8-10, when it is hoped the project will meet with such encouragement that we shall soon see such a central standardizing agency in operation.

THE TRADESMAN.

Writing of "Foundrymen's Associations and Progress in Founding," Mr. Putnam says:

"The advance made in general knowledge of iron founding during the last four years is simply wonderful. We have had a great deal of discussion of many points of foundry practice, both in the association meetings and in the various trade journals. And there has been a good deal of readjusting of individual opinions, as a matter of course; for this is an era of education.

"It is no doubt true that the art of founding was clothed about in a sort of haze. There was a great deal of mystery about it,

There had always been a disinclination among foundrymen to impart knowledge of their trade. Less than five years ago I heard a foreman ask another foreman what was his best dry sand mixture, and the answer was, 'I don't tell anybody what is my best dry sand mixture. You give away your bread and butter when you give away your sand mixtures!' Well, it is to-day an easy matter for anybody to learn just how to mix sand for dry sand molding, or for any other kind. Most of us know that there are many various proportions of ingredients in dry sand mixtures, but this is not the present question. The thing I wish to call attention to is the liberal education that foundrymen generally have received through the foundrymen's associations and the trade journals within the past few years. Five years ago or less I wished to know the analysis of the iron that I was using and the furnace operations could not furnish it. To-day the following note came to my hand:

"————, Ala., April 22, 1898.

The ....., Atlanta, Ga.:

Dear Sirs:—In accordance with your wire of April 20, we ship you to-day one car of No. 2 foundry ———, which is exactly the same in every respect as the last car shipped.

For your information we add that the analysis of this iron is: Silicon, 1.88; phosphorus, .312; sulphur, .018, and manganese, 1.40. We trust that car will reach you in due time," etc.

(Signed) ————————

Now, wouldn't it have surprised a customer to receive such analysis some years ago? Indeed it would.

It happens that this iron is perfectly satisfactory in every respect; and if at some future time iron of inferior quality be received this analysis will be referred to, and it will be compared with the analysis of the "off" iron, and it will thus be easy to straighten matters out.

In the matter of economy in cupola management also there has been very great advance. Papers read upon this topic before the various foundrymen's associations have received wide pub-

licity through the trade journals, and so the most advanced knowledge herein has become the property of all who are in line with the current of events in progressive founding. This enlightenment has also been a protection against imposition by unprincipled persons who formerly were able to sell foundry secrets (?) that were simply frauds.

Again, the art of molding has been taught more rapidly and effectively than ever before, in a general way. The world at large has been very greatly benefited hereby. Witness the current prices of castings as compared with the prices a few years ago; for the diminution in price has been much greater than the decline in cost of raw materials. And this has been made possible because the foundryman is able to produce so much more economically than before.

Last year, when The Tradesman was agitating the question of organizing a southern foundrymen's association, one firm wrote us, asking: "What good purpose would a foundrymen's association serve?" and peremptorily declining to have anything to do with it! We did not answer the query, simply because we anticipated their retort. They were a large and prosperous concern, and probably belonged to the class that avoid association lest they may possibly impart benefit. "They never will be missed"—and the associations and all their beneficent influences will continue. There will be no backward step. The benefits already achieved promise still greater for the future; and men do not voluntarily relinquish a good thing."

Referring to the recent discussions relating to uniformity in analysis, this journal says:

An attentive reading of Mr. Thomas D. West's paper indicates a decided need of greater accuracy in chemical analysis of iron. An analysis that misleads is worse than none. When you get a description of a consignment of pig iron it ought to describe that particular iron. It seems, however, that it is very likely to describe something else. Since there is no doubt that chemistry is going to be employed universally at the blast furnace, let us have a system that can be relied upon.

The whole business of chemical analysis of foundry iron is new; and to the majority of foundrymen it is totally unfamiliar. But enough has been written upon the question to convince anybody who is open to conviction that chemical analysis is a practice that has come to stay; and now the reasonable thing to do is to perfect the system.

Mr. West's tables of comparative analyses seem to indicate a need of decided improvement upon present methods as commonly practiced. The difference in results of the several analyses is so wide as to interfere greatly with their utility. It seems to me that his suggestion of establishing a central laboratory where standardized drillings may be promptly and cheaply secured would be hard to improve upon. It is to be hoped that the chemists and metallurgists generally will take up this discussion and prosecute it to the establishment of some system by which chemical analysis shall command general and well founded confidence.

Commenting upon a recent article in the Iron Trade Review, contributed by A. E. Outerbridge, Jr., on the "Effect of Manganese in Cast Iron" (see A. F. A. Journal for May.—Ed.) Mr. Putnam says:

This specific information as to the effect of manganese in cast iron should be of great value especially to the producer of chilled castings. It is fair to state, however, that all metallurgists do not agree in this matter. I remember that some years ago the agent of an iron firm told us that iron containing much manganese would be comparatively soft, though it might show a good chill. More recently a metallurgist of some note assured me that this was an error; that manganese was a hardening agent. And now comes Mr. Outerbridge and says that the manganiferous chill is comparatively soft. Mr. Outerbridge is a metallurgist of world-wide reputation, and he would not print an opinion on so important a question without ample grounds to sustain it. Some years ago a gentleman speaking at a meeting of the Foundrymen's Association, said that he had added some ferro-manganese to molten iron and found that the result was a

stronger product. But, he added, he was afraid to use it much, as he did not know what other effects might be produced, and it might prove a detriment in scrap. That is, he seemed to think that if everybody should get to adding manganese to iron general havoc might result. But if Mr. Outerbridge is correct, and the manganese is ejected from the iron before casting, then the effect would seem to end here. The relapse of the iron product to its normal state upon remelting very strongly sustains Mr. Outerbridge's position.

He says that the addition of a small per cent of manganese gives 30 or 40 per cent stronger iron. The question arises, why not use it in all castings requiring great strength?

The philosophy by which he explains the effect of the ferro-manganese addition suggests possibilities in the manipulation of cast iron that might revolutionize some important branches of manufacture. For instance, if a handful of ferro-manganese thrown into a ladle of molten iron will capture the oxygen, and then retire, taking its prisoner along, then why may we not expect to find some other simple agent that shall be quite as effective in other beneficial ways? By addition of ferro-manganese the depth of chill was diminished 25 per cent. From long experience in making chilled castings, I can readily see where this information can be of great help, provided the use of the manganese to reduce chilling tendency would not otherwise affect the quality of the "chill." As, for instance, if the chill test from the receiving ladle show too deep a chill, the addition of a small dose of ferro-manganese would readily correct the matter. Now, if Mr. Outerbridge will kindly give us a handful of something else that may be thrown into the ladleful of iron that happens to be just a little deficient in chilling tendency without deleterious result, he will make us almost happy!

Under the title "Storage of Coke" Mr. Putnam writes as follows:

"The Western Foundrymen's Association recently discussed the question whether it was important that coke should be sheltered from the weather. When I managed foundries in the north

we always kept the foundry coke well housed and it was at that time generally thought important to do so. But in this latitude, during a period of more than eight years, our coke has been always exposed; and I have never known any deterioration, except that some coke after long exposure would become soft and would crumble and break up into small pieces, thus entailing considerable loss. Some brands of coke, however, are exempt also from this liability to deterioration. In the discussion above referred to one speaker strongly opined that the rain would wash the sulphur from the coke. It was also suggested that the atmosphere would extract the sulphur. But later admission by the latter would seem to indicate the fallacy of this theory, for, he said, a spotted piece of coke that had been exposed for about two months was sent to the maker for analysis, and the latter confessed that it contained sulphur in great excess!

Mr. Sorge, in answer to a question, said that water would dissolve sulphur. If this is true, then it would seem as if it would be a very easy matter to rid so porous a structure as coke from this injurious substance.

Whatever may be the opinions arrived at by the members of the Western Foundrymen's Association, my own practical experience informs me that no appreciable effect is produced on good coke by an exposure to the weather, rain, snow or July sunshine, of a few weeks' duration only. In short, a shed for coke, except against snow, is an expensive superfluity.

Another feature discussed was the element of moisture in the coke. One speaker averred that he had always noticed that after rain, when the coke, as charged into the cupola was very wet, the iron was melted more effectively—it was hotter than when the coke was dry. It was suggested that the water added no heat producing quality, but that its presence probably prevented combustion, thus conserving the maximum of heat units till the charge should reach the place for its effective consumption, viz., the melting zone.

This question of the effect of moisture has been frequently discussed, but I do not remember to have met with this idea

before. But it seems to me very reasonable, and it is strange that it has not been advanced before, or, if advanced, that it has not received more prominent notice.

Who has not observed the blacksmith saturate the outlying coal and carefully pack it about his fire? Thereby he prevents the wasteful consumption of fuel, and concentrates the fire to a compass wherein it may be most economically used. The water does not add to the heat of his forge, but, on the contrary, it diminishes it, and by preventing wasteful combustion, adds very greatly to the effective heat units of the coal.

If, however, there would indeed be any advantage in wetting the coke before charging in the cupola, it would probably be, on the whole, but slight. If the proportion of coke to iron were reduced because of advantage in moisture, once forgetting or for any other reason omitting to use the water, would entail a loss by dull iron that would counterbalance the savings of a good many 'heats.'

The cost of coke as now economically employed in melting iron, is small, and it is quite probable that more money can be made by giving attention to other factors that pertain to the production of castings."

Referring to Mr. Outerbridge's paper on "Manganese in Cast Iron," and Mr. Putnam's comment thereon, J. E. Johnson, Jr., writes as follows:

"Mr. Outerbridge's statements concerning manganese and its effects on castings are very interesting, but one cannot avoid thinking that he may be in error, at least in part, in his opinions as to the effect of manganese on chilling and particularly on the quality of chill produced where it is present.

Granting that the element is not present in excessive quality, say not over 1 per cent, it seems probable that its indirect effect is much greater than its direct, notably in its action on sulphur and carbon.

Of the first it is possible to speak with certainty since it is well known that metallic manganese has a stronger affinity for sulphur than iron, and therefore the addition of metallic man-

ganese to a chilly (hard) iron, which is very liable to be high in sulphur, would be almost certain to reduce the sulphur contents, the sulphide of manganese passing off with the slag as explained by Mr. Outerbridge. That enough sulphur could be removed by the amount of ferro-manganese given by Mr. Outerbridge, to make a very considerable difference in the quality of a casting may be shown by a few figures.

Mr. Outerbridge speaks of using, say 6 per cent of ferro manganese, and if this contains 80 per cent of manganese there will be, say .13 per cent of this element introduced. Manganese will take up 32-55 of its own weight of sulphur, or say 58 per cent. Now, if all the manganese is saturated with sulphur there will be removed 13.x.58 equals .075 per cent of the latter element. This is about half as much as a good chilling iron ought to be allowed to have in it under any circumstances, and this amount removed from an iron, pretty bad as to sulphur, would make a fairly good one of it.

The great effect sulphur has in throwing carbon into the combined or chilling state and in producing shrinkage makes it appear that this is at least an extremely plausible explanation of the effects observed by Mr. Outerbridge.

This, however, is no proof that manganese per se or through its effect on the carbon may not be a hardening element. When we consider the enormous hardness of manganese steel it appears very probable that it is.

That is to say, of two irons of identical composition, except that one was considerably higher in manganese united with the iron (instead of carried off as sulphide in the slag) the writer would expect the one with the higher manganese contents to be the harder.

It should be noted also that in making such a composition it it not sufficient to take the analysis of the pig iron as proving that the manganese of one bears a certain ratio to that of the other, since a large portion of this element when present in considerable quantity, is lost in the slag in remelting, presumably in carrying off sulphur taken up from the coke.

If this view is correct it will go a long way to reconcile the diametrically opposite views concerning this element long held by different authorities.

As Mr. Outerbridge's contention that a manganese chill is different from any other chill, apart from the action on sulphur just alluded to, it seems to the writer improbable. Manganese alone is not commonly supposed to cause segregation to any appreciable extent which is as one would expect from its similarity chemically to iron, while if it forms a carbide, or unites with iron to form a double carbide, the percentage of such a compound must be so small with any ordinary manganese contents that it would have to produce segregation in a very high degree to alter the nature of the chill due to the iron alone. The writer does not know of any evidence bearing directly upon this point but the hardness, toughness, and strength of manganese steel would seem to indicate the improbability of such action.

It seems to the writer that the whole question of cast iron is studied too much apart from that of steel in all such matters and he is willing to confess that the dividing line between these two metals is not always very clear, to him. White cast iron of good quality could have this analysis: P. .08, S. .04, Si. 0.10, C. combined 2.50, C. graphitic, trace; will any one say that this might not equally well be the analysis of a very high carbon steel, and are not the two metals much alike in their physical characteristics also? hard, white, and brittle? It is true that tool steel, as commonly seen after having been hammered into bars, would show a much finer grain than the iron, but if it were taken as it came out of the crucible; simply allowed to solidify and broken, would it not have much larger crystals and still further resemble the iron?

Microscopic examination would probably show some difference even then, and physical tests would probably show some, but are there not vastly wider gaps between the ordinary commercial steels of different kinds than there is between these?

This, however, is somewhat of a digression and to return to the article under consideration, and Mr. Putnam's concluding para-

graph in particular, he asks if there is not some other substance which can be used to reduce the amount of chill in accordance with the showing made by the test-ladle, and by a singular coincidence, in the same copy of The Tradesman there is a description of the manufacture of carborundum, or silicide of carbon, which should be the ideal substance for this purpose, since its two elements are those whose presence in the iron by their amount and condition control the chilling properties of the iron entirely. A very small variation in the silicon exerts a great influence on the carbon in chilling iron, an increase in its amount converting a part of the carbon from combined to graphitic, while the carbon present with the silicon will be absorbed by the iron with advantage. Moreover, both of these elements are much more powerful reducing agents than manganese, and will reduce the oxide of either manganese or iron, leaving the manganese free to carry off any sulphur it may come in contact with, and reducing any oxide of iron which may be present to cause segregation, or "dirty spots."

It should be noted that this last is the only function in the way of deoxiding that the ferro manganese used by Mr. Outerbridge can perform, since the metalloids in cast iron all have a stronger affinity for oxygen than manganese and, therefore, refuse to be deoxidized by it.

Of course silicide of carbon used to reduce the amount of chill in the way proposed would be free from any pernicious influence on the quality of the chill, and would, therefore, be the ideal substance for which Mr. Putnam inquires, granting Mr. Outerbridge's contention as to the effect of manganese upon the quality of the chill to be correct. It will be seen that if the views here advanced are correct, if the trouble with an iron which chilled too heavily were high sulphur, then ferro-manganese would probably be the best thing to add, but if the iron were simply too hard, too low in silicon and consequently in graphitic carbon, then the silicide of carbon would be best, but either would probably have considerable effect under either condition, and it would seem as though a mixture could hardly go astray

for the purpose, especially as the sulphur in chilling iron is apt to be high.

As to the quantity of silicide of carbon to be added, that is something on which no rules can be given, but a tenth of one per cent would almost certainly have an appreciable effect. As to its cost I am not informed, but from the fact that it is used in steel works for kindred purposes, to some extent, it probably is not prohibitive."